Recovery Outline

New Mexico Meadow Jumping Mouse (*Zapus hudsonius luteus*)

Current Classification: Endangered

U.S. Fish and Wildlife Service
New Mexico Ecological Services Field Office
Albuquerque, New Mexico

June 2014

Photo courtesy of J. Frey

1.0 INTRODUCTION

The purpose of this recovery outline is to provide an interim strategy to guide the conservation and recovery of the New Mexico meadow jumping mouse (jumping mouse) until a final recovery plan is completed. Recovery needs of the species will require cooperation among the U.S. Fish and Wildlife Service (Service), and other Federal and State agencies, Tribes, and the public. An outline of potential recovery actions for the jumping mouse may help interested stakeholders understand how we envision jumping mouse conservation proceeding until a recovery plan is finalized. The current outline is based on the final Species Status Assessment Report (SSA Report), as well as preliminary objectives and actions needed for recovery. The preliminary recovery strategy is based on the best available scientific and commercial information. Region 6 has concurred with this outline.

1.1 Species common and scientific name:
New Mexico meadow jumping mouse (*Zapus hudsonius luteus*)

1.2 Lead Regional Office/Cooperating Regional Offices: Region 2/Region 6

1.3 Lead Field Office/Cooperating Field Offices:
New Mexico Ecological Services Field Office/Arizona Ecological Services Field Office, Colorado Ecological Services Field Office

1.4 Contact Biologist:
Eric Hein 505-761-4735 (New Mexico);
David Smith 928-556-2183 (Arizona);
Terry Ireland (970) 628-7188 and Alison Michael 303-236-4758 (Colorado)

1.5 Listing Status and date: Endangered, June 10, 2014

1.6 Recovery Priority Number: 3C

2.0 BRIEF METHODOLOGY

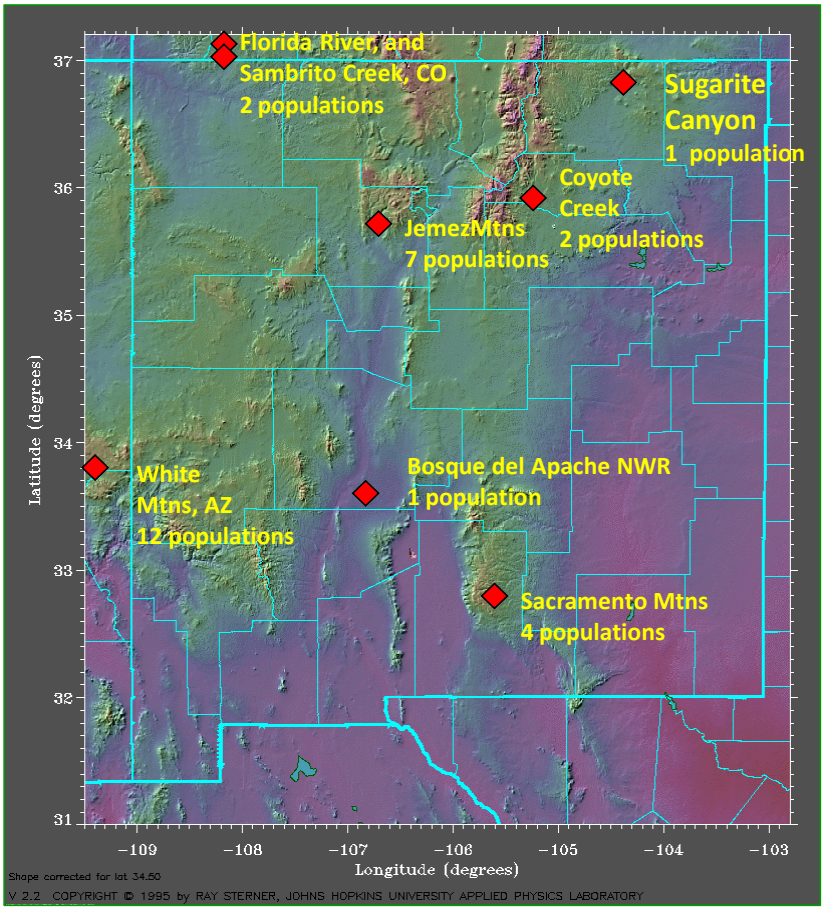
Please see the Final New Mexico Meadow Jumping Mouse Species Status Assessment Report (SSA Report; Service 2014, entire), available online at www.regulations.gov, Docket No. FWS–R2–ES–2013–0023, for background ecological information on New Mexico Meadow jumping mouse. This SSA Report documents biology and natural history, and assesses demographic risks (such as small population sizes), threats, and limiting factors in the context of determining viability and risk of extinction for the New Mexico meadow jumping mouse. In the SSA Report, we compile biological data and a description of past, present, and likely future threats facing the species. Because data in these areas of science are limited, some uncertainties are associated with the assessment. Where we have substantial uncertainty, we made our necessary assumptions explicit in the SSA Report. We base our assumptions in these areas on the best available information.

3.0 RECOVERY STATUS ASSESSMENT

The SSA Report considers what the jumping mouse needs to ensure viability. We generally define viability as the ability of the species to persist over the long term and, conversely, to avoid extinction. We next evaluated whether the identified needs of the jumping mouse currently are available and the repercussions to the species when fulfillment of those needs is missing or diminished. We then consider the factors that are causing the species to lack what it needs, including historical, current, and future factors. Finally, considering the information reviewed, we evaluate the current status and future viability of the species in terms of resiliency, redundancy, and representation.

3.1 Biological Assessment

The jumping mouse is a small, nocturnal, solitary mammal and an obligate riparian subspecies. Its historical distribution likely included riparian wetlands along streams in the Sangre de Cristo and San Juan Mountains from southern Colorado to central New Mexico, including the Jemez and Sacramento Mountains and the Rio Grande Valley from Española to Bosque del Apache National Wildlife Refuge, and into parts of the White Mountains in eastern Arizona.



3.2 Species' Range-wide Population Status and Trends

Based on historical (1980s and 1990s) and current (from 2005 to 2012) data, the distribution and abundance of the New Mexico meadow jumping mouse has declined significantly rangewide. The majority of local extirpations have occurred since the late 1980s to early 1990s; recent surveys have indicated that about 70 formerly occupied locations are now considered to be extirpated. Since 2005, there have been 29 documented remaining populations (2 in Colorado, 15 in New Mexico, and 12 in Arizona) spread across 8 conservation areas (2 in Colorado, 5 in New Mexico, and 1 in Arizona) (Figure ES-1; SSA Report). Nearly all of the current populations are isolated and widely separated, and all of the 29 populations located since 2005 have patches of suitable habitat that are too small to support resilient populations of jumping mice. None of them are larger than the needed 27.5 to 73.2 ha (68 to 181 ac) to be viable, and over half of them are only a few acres in size (see "2.7.2 Habitat Patch and Population Sizes" SSA Report). In addition, 11 of the 29 populations documented since 2005 have been substantially compromised since 2011 (due to water shortages, grazing, or wildfire and post-fire flooding), and these populations could already have disappeared (Table 1; SSA Report). Seven additional populations in Arizona may also be compromised due to post-fire flooding following large recent wildfires.

Four of the eight conservation areas have two or more locations known to be occupied by the mouse since 2005, but all are insufficient (too small) to support resilient populations and their disjunct geographic distribution is beyond the movement and dispersal ability of the subspecies. Ideally, appropriately sized patches of suitable habitat should be no more than about 200 m (656 ft), which would encompass the majority of regular (daily and seasonal) movements of individual mice (see "2.7.1 Habitat Connectivity" SSA Report). The remaining four conservation areas have only one known location occupied by the mouse since 2005, and each population is insufficient (too small) to be resilient. Therefore, the jumping mouse does not currently have the number and distribution of resilient populations to provide the needed levels of representation and redundancy (genetic and ecological diversity) for the species to demonstrate viability.

3.3 Species Viability Needs

Life History Drivers: For the New Mexico meadow jumping mouse to be considered viable, individual mice need specific vital resources for survival and completion of their life history. One of the most important aspects of the jumping mouse's life history is that it hibernates about 8 or 9 months out of the year, longer than most mammals. Conversely, it is only active 3 or 4 months during the summer. Within this short time frame, it must breed, birth and raise young, and store up sufficient fat reserves to survive the next year's hibernation period. In addition, jumping mice live only 3 years or less and have one small litter annually with 7 or

fewer young, so the species has limited capacity for high population growth rates due to this low fecundity. As a result, if resources are not available in a single season, jumping mice populations would be greatly impacted and may have lower reproduction and over-winter survival during hibernation. Survival rates are likely similar to the Preble's jumping mouse (*Z. h. preblei*), which ranges from 9 to 76 percent (see "2.3 Life History" SSA Report). The jumping mouse's life history (short active period, short life span, low fecundity, specific habitat needs, and low dispersal ability) makes populations highly vulnerable to extirpations when habitat is lost and fragmented.

Individual Needs: The jumping mouse has exceptionally specialized habitat requirements to support these life history needs and maintain adequate population sizes. Habitat requirements are characterized by tall (averaging at least 61 cm (24 in)), dense, riparian herbaceous vegetation primarily composed of sedges and forbs. This suitable habitat is only found when wetland vegetation achieves full growth potential. These areas are associated with seasonally available or perennial flowing water. This dense riparian herbaceous vegetation is an important resource need for the jumping mouse because it provides vital food sources (insects and seeds), as well as the structural material for building day nests that are used for shelter from predators. Connectivity of habitat facilitates movement of jumping mice by providing cover while foraging or exploring for mates and promotes dispersal to new sites. It is imperative that the jumping mouse have rich abundant food sources during the summer so it can accumulate sufficient fat reserves to survive the long hibernation period. In addition, individual jumping mice need intact upland areas that are up gradient and beyond the floodplain of rivers and streams and adjacent to riparian wetland areas because this is where they build nests or use burrows to give birth to young in the summer and to hibernate over the winter.

Population Needs: Suitable habitat conditions need to be in appropriate locations and of adequate sizes to support healthy populations of the jumping mouse. Historically, these wetland habitats would have been in large patches located intermittently along long stretches of streams. The ability of jumping mouse populations to be resilient to adverse stochastic events depends on the robustness of a population and the ability to recolonize if populations are extirpated. Counting individual mice to assess population sizes is very difficult because the subspecies is trap wary and hibernates for an extended time; thus data are unavailable. In considering the area needed for maintaining resilient populations of adequate size with the ability to endure adverse events, we estimate that resilient populations of jumping mice need suitable habitat in the range of at least about 27.5 to 73.2 ha (68 to 181 ac) along 9 to 24 km (5.6 to 15 mi) of flowing streams, ditches, or canals. This distribution and amount of suitable habitat would allow for multiple subpopulations of jumping mice to exist along drainages and would provide for sources of recolonization if some areas were extirpated due to disturbances. The suitable habitat patches must be relatively close together because the

jumping mouse has limited dispersal capacity for natural recolonization. In fact, the subspecies appears to exhibit extreme site fidelity for daily activities (i.e., movements to and from day nesting and feeding areas) (Frey and Wright 2012, p. 24).

Species Needs: Range-wide, we determined that the jumping mouse needs at least two resilient populations (where at least two existed historically) within each of eight identified geographic conservation areas. This number and distribution of resilient populations is expected to provide the species with the necessary redundancy and representation to provide for viability.

3.4 Monitoring Needs

The New Mexico meadow jumping mouse is trap shy and is more difficult to trap than other small mammals (Morrison 1988, p. 47; Frey 2007d, p. 1; 2011a, p. 7). Survey and monitoring of jumping mice is complicated by their apparent reluctance to readily enter the most commonly used folding, aluminum live box trap, called the Sherman trap, and by the species' lengthy period of hibernation. In particular, selective trap placement within microhabitats is also required to maximize capture probabilities (Morrison 1991, p. 3; Frey 2007d; 2013d, pp. 25–27). Recaptures of jumping mice are also generally low, suggesting trap avoidance behavior (Morrison 1991, p. 3). Recent surveys have relied on detection/nondetection (presence/absence) data to determine whether jumping mice persist in areas that contained historic populations or areas that currently contain suitable habitat. Species-specific surveys have been useful for determining occupancy, but are limited in their usefulness for capture probabilities and therefore, estimating population size. For these reasons, Frey (2005a, p. 68; 2011, p. 9; 2013d, pp. 24, 28, Table 3) recommended the targeted survey effort should be 400 to 700 trap-nights over 3 to 5 consecutive nights from May to September, depending on elevation, using Sherman live traps baited with sweet grain mixture to determine presence or absence of jumping mice. Frey (2007d, entire; 2011, p. 9) noted that jumping mice are rarely incidentally captured during general small mammal surveys and are almost never captured by inexperienced biologists, indicating species-specific surveys by qualified surveyors are usually necessary to determine presence.

3.5 Threats Assessment (Primary Causes and Effects from SSA)

Because the jumping mouse requires such specific suitable habitat conditions, populations have a high potential for extirpation when habitat is altered or eliminated. When localities are extirpated there is little or no opportunity for natural recolonization of the area due to the species' limited dispersal capacity and the current conditions of isolated populations.

There has been a significant reduction in occupied localities likely due to cumulative habitat loss and fragmentation across the range of the jumping mouse. The past and current habitat

loss has resulted in the extirpation of historical populations, reduced the size of existing populations, and isolated existing small populations. Ongoing and future habitat loss is expected to result in additional extirpations of more populations. The primary sources of past and future habitat losses are from grazing pressure (which removes the needed vegetation) and water management and use (which causes vegetation loss from mowing and drying of soils), lack of water due to drought (exacerbated by climate change), and wildfires (also exacerbated by climate change). Additional sources of habitat loss are likely to occur from scouring floods, loss of beaver ponds, highway reconstruction, coalbed methane development, and unregulated recreation.

These multiple sources of habitat loss are not acting independently, but likely produce cumulative impacts that magnify the effects of habitat loss on the small, remaining jumping mouse populations.

Main Stressor: Habitat Loss

Significant reduction of the amount of suitable habitat eliminates populations and reduces carrying capacity for remaining populations.

Main Sources of Habitat Loss:

- **Grazing –** eliminates herbaceous vegetation.

- **Lack of water –** drought or irrigation diversion can result in loss of saturated soils and loss of herbaceous vegetation.

- **Secondary sources of habitat loss include –** severe wildland fire, scouring flooding, highway reconstruction, unregulated recreation, loss of beaver ponds, and mowing of riparian vegetation.

3.6 Conservation Assessment

Very few recovery actions have been implemented since 2005. Bosque del Apache NWR has mowed and cleared areas of decadent willows in an attempt to restore and expand jumping mouse habitat along the Riverside Canal (Service 2011, entire; 2011a, entire; 2012e, entire). Additionally, they have purchased and replaced inefficient and outdated water control structures with efficient Langemann water control structures, which are capable of maintaining a stable water level in ditches throughout the active season to benefit the jumping mouse (Service 2011, entire; 2011a, entire).

The Santa Fe National Forest has also recently proposed two projects to limit livestock access and improve overall riparian habitat along the Rio Cebolla and Rio de las Vacas (Forest Service 2014a, entire; 2104, entire). Additionally, the Lincoln National Forest recently installed two pipe fences to reduce the amount of livestock entering the Agua Chiquita exclosures because previous barb wire fences were regularly broken, cut, or downed.

3.7 Summary Statement of Recovery Needs

Currently, without active management (grazing management; water and vegetation management), the NM meadow jumping mouse exhibits:

No Resiliency

- Each of the populations will continue to be too small to be resilient and are highly vulnerable to future extirpation.
- Climate change and high impact wildfire will continue to threaten many current locations with extirpation.

Low Redundancy

- With no current resilient populations, the species has no redundancy (populations are too small and isolated and have a low probability of persistence).

Low Representation

- Only 4 of 8 conservation areas have multiple populations (none are resilient).
- Some diversity is maintained across the 8 conservation areas, but no adequate resilient populations exist.

For these reasons, overall species viability is low, defined by a high probability of becoming extinct between now and the next 10 years. In addition, 11 of the 29 populations documented since 2005 have been substantially compromised since 2011 due to drought, wildfire, and post-fire flooding, and these populations could already be extirpated. At this rate of habitat and population diminishment, the probability of persistence of the subspecies as a whole is severely compromised in the near term because the threats are expected to continue.

To address the current status of the mouse and work toward long-term viability and recovery of the subspecies, recovery efforts should preferentially focus on restoring habitats and increasing the connectivity among suitable areas. The expansion of all remaining populations is an immediate and long-term need for the jumping mouse.

4.0 PRELIMINARY RECOVERY STRATEGY

4.1 Recovery Priority Number: 3C

The recovery priority number of 3C indicates a high degree of threat, a high recovery potential, the listed entity is a subspecies, and conflict exists. The threats are high due to ongoing sources of habitat loss, degradation, and modification, including grazing pressure (which removes the needed vegetation), water management and use (which causes vegetation loss from mowing and drying of soils), lack of water due to drought (exacerbated by climate change), and wildfires (also exacerbated by climate change). Additional sources of habitat loss are likely to occur from floods, loss of beaver, highway reconstruction, residential and commercial development, coalbed methane development, and unregulated recreation. Although the New Mexico jumping mouse has lower fecundity than most mice species, its high potential for recovery is based on the species' intimate link to the state of its habitat. The dynamic nature of early seral stage riparian vegetation, with protection, can promote rapid development into suitable habitat within several years, with an expected tandem response of increased New Mexico jumping mouse populations. Restoration of dense, herbaceous riparian vegetation will likely involve modifying or limiting actions that currently preclude the growth of suitable habitat. Thus, restoration of New Mexico meadow jumping mouse habitat will play an important role in the future viability and recovery of populations by creating additional suitable habitat to recover the subspecies.

4.2 Recovery Vision

Because the main factor making the New Mexico meadow jumping mouse vulnerable to extinction is the loss of suitable habitat, with a secondary factor of low population size in the few remaining habitat fragments, in order to ensure the species' viability its habitat must be protected and restored, particularly in areas less vulnerable to the potential effects of climate change, and existing populations should be expanded as rapidly as possible within each of the conservation areas. Establishing connectivity between all eight conservation areas is not possible; therefore, establishing multiple local populations within each conservation area is the best defense against local extirpation and complete extinction. Available information regarding the jumping mouse suggests the subspecies exhibits extremely limited mobility, and the poor quality and discontinuous spatial extent of required habitat components along specific stream reaches or segments of ditches and canals is lacking (see "6.5 Conservation Opportunities" SSA Report). Thus, to improve the species' viability and move toward recovery, efforts should preferentially focus on restoration of habitats and the expansion of all remaining populations into increased, suitable habitat to provide additional areas for jumping mice to become established within the eight conservation areas. (e.g., see Malaney *et al*. 2012, p. 10).

Historically, populations were likely distributed throughout drainages, with a series of inter-connected local populations (also called sub-populations) occupying suitable habitat patches within individual streams. Inter-connected local populations were likely arranged within suitable habitat patches along streams in such a way that individuals could fulfill their daily and seasonal movements of about 100 m (330 ft), but also occasionally move greater distances (i.e., 200 to 1 km (656 to 3,280 ft)) to move or disperse to other habitat patches within stream segments (Frey and Wright 2012, p. 109). As such, we assume that the jumping mouse likely existed historically in metapopulations with occasional exchange of individuals among local populations within stream segments (Morrison 1991, pp. 18–20; Frey 2011, pp. 76, 78; 2012a, p. 6). This ability to have multiple local populations along streams is important to maintaining genetic diversity and providing sources for recolonization when local populations are extirpated. Movement, dispersal, and gene flow require connectivity of suitable habitat along riparian corridors (Vignieri 2005, entire). This habitat connectivity among local populations is important to support resilient populations of the jumping mouse (Mawdsley *et al*. 2009, entire).

Consequently, to emulate conditions wherein the jumping mouse can achieve self-sustaining numbers and move toward recovery, interconnectivity using realistic movement distances between local populations should be incorporated into habitat design and restoration. For example, Frey and Wright (2012, p. 43) recommended that the distribution of populations could be expanded by removing decadent willows to promote the growth of herbaceous vegetation while avoiding habitat gaps greater than 192 m (630 ft). Currently unsuitable habitat that is adjacent to the 29 populations, where the jumping mouse has been located since 2005, needs to be protected and restored along streams, ditches, and canals to provide about 9 to 24 km (5.6 to 15 mi) including about 27.5 to 73.2 ha (68 to 181 ac) of continuous suitable habitat to support high levels of population viability. These adjacent lands are likely unoccupied, but, at a minimum, should contain sufficient seasonally available waters and moist soils to develop dense riparian herbaceous vegetation to support one or more life-history functions of the jumping mouse. There are specific stream reaches or segments of ditches and canals within each of the eight geographic management areas that currently contain seasonally perennial water, and have either been found to be recently occupied by the jumping mouse, or when restored, could provide crucial opportunities for connectivity to facilitate regular daily and seasonal movements, dispersal, and genetic exchange.

Although jumping mouse habitat is dynamic and with protection should develop into suitable habitat within several years, slow rates of population growth inherent to the subspecies' biology necessitate long-term commitments to habitat restoration and protection. This means we will need to cooperatively work with Federal, State, Tribal, and private entities to provide reasonable protection from disturbance that removes, significantly alters, or precludes the development of dense riparian herbaceous vegetation caused by livestock grazing, irrigation water use and management, highway reconstruction, severe wildland fires, unregulated

recreation, mowing of riparian vegetation, and loss of beaver ponds. Recovery actions should focus on areas with a high potential for restoration of suitable habitat to enable the reestablishment of the New Mexico meadow jumping mouse within areas that were historically occupied. Recovery and delisting of the New Mexico meadow jumping mouse is possible, but it will likely not attain the population numbers or area of the estimated historical range of the species; yet addressing impacts from threats in and adjacent to occupied habitats will recreate suitable conditions and allow for re-establishment of viable jumping mouse populations within the eight conservation areas.

Conservation management will also include continuing to conduct research on the critical aspects of jumping mouse life history (e.g., reproduction, abundance, survival, movement behavior). Importantly, research is needed to determine whether jumping mouse use of restored suitable habitat differs between long (i.e., > 1 km (0.6 mi)) linear stretches that are contiguous or a series of small linear segments than are not contiguous, but separated from one another by less than several hundred meters.

4.3 Brief Action Plan

1. Establish partnerships to design and install effective barriers or exclosures or change livestock management techniques (e.g., fencing, reconfiguration of grazing units, off-site water development, or changing the timing or duration of livestock use) to limit ungulate grazing and protect riparian habitats from damage.

2. Work cooperatively with stakeholders to maintain the required microhabitat components or modify or limit actions (e.g., bridge and road realignment projects, water use and management, stream restoration, and vegetation management) that preclude their development and restoration, in order to stabilize and expand current jumping mouse populations.

3. Identify priority areas to reduce fuels to minimize the risk of severe wildland fire and identify techniques for post-fire stabilization in areas that burn.

4. Modify off-road vehicle use and manage dispersed recreation through fencing, signage, education, and timing of use.

5. Facilitate the natural expansion of jumping mouse habitat through the management and restoration of beaver. In New Mexico, beaver can no longer be relocated or transplanted without written consent from all property owners, land management agencies, or other affected parties (e.g., irrigation districts) within an 8-kilometer (5-mile) radius of the proposed release site or connective waters (New Mexico Department of Game and Fish 2009, entire).

6. Complete an emergency contingency and salvage plan to capture jumping mice and bring individuals into captivity in the event of severe wildland fire, post-fire flooding, or severe drought.

7. Establish a monitoring protocol to determine presence/absence or estimate the abundance of jumping mouse populations.

8. Investigate the genetic diversity of populations to identify and address where long term management strategies may be needed to enhance their genetic integrity.

9. Formally evaluate whether assisted translocation or a captive breeding program for jumping mice would be beneficial as a recovery option.

10. Conduct research on the critical aspects of jumping mouse life history (e.g., reproduction, abundance, survival, movement behavior).

5.0 PREPLANNING DECISIONS

Shortly after the jumping mouse is listed as endangered, a recovery plan will be prepared pursuant to section 4(f) of the Act. The recovery plan will include objective, measurable criteria, which when met, will result in a determination that the species be removed from the Federal list of Endangered and Threatened Wildlife and Plants. Recovery criteria will address all threats meaningfully impacting the species. The recovery plan will also estimate the time required and cost to carry out those measures needed to achieve the goal of recovery and delisting. The plan will be single species.

Plan preparation will be under the guidance of the New Mexico Ecological Services Field Office. The Service may appoint a cross-regional recovery team to undertake development of the recovery plan. Alternatively, a plan may be developed internally by the Service and presented for comment to the public and stakeholders.

Approval:

Joy E Nicholopoulos Date: 6/9/14

Dr. Benjamin N. Tuggle
Regional Director
U.S. Fish and Wildlife Service, Region 2

Acting

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